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Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area Climate of 2008

Natural Resource Data Series NPS/ERMN/NRDS—2010/XXX

ON THE COVER
Photo description. Sunset over West Branch of the Delaware River near Shehawken Creek
Photograph by: Caleb Tzilkowski

Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area Climate of 2008

Natural Resource Data Series NPS/ERMN/NRDS—2009/XXX

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Table of Contents

Page

Figures

Page

Tables

Page

List of Key Acronyms

COOP	National Weather Service Cooperative Observer Program
CWOP	Citizen Weather Observer Program
DEWA	Delaware Water Gap National Recreational Area
FAA	Federal Aviation Administration
IFLOWS	Integrated Flood Observing and Warning System
NADP	National Atmospheric Deposition Program
NARR	North American Regional Reanalysis
NCDC	National Climatic Data Center
NWS	National Weather Service
PDSI	Palmer Drought Severity Index
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RAWS	Remote Automated Weather Stations
UPDE	Upper Delaware Scenic and Recreational River
USGS	United States Geological Survey

Executive Summary

Weather and Climate for Calendar Year 2008

The winter was seasonably mild (averaging more than 2°F/1.2°C above normal). The spring also had above normal temperatures. The summer of 2008 was a bit warmer than average, but the autumn turned cooler than the long-term mean. A wet winter was followed by a dry spring; a moist summer and a wet autumn. In fact, it was the wettest winter in both Pennsylvania Climate Division 1 and New York Climate Division 2 since records began in 1895. The wettest periods were during the first week of March and the second week of December. The snowiest month was February, though an unseasonably early snowstorm occurred on October 28th damaging some trees still in leaf. The most active thunderstorms occurred in mid-June, late July and mid-August. The region felt the effects of tropical storm Hanna on September 6-7 with heavy rain and the indirect effects of Hurricane Kyle with more rain on September 28.

Climate Indicator Status and Trends

The year averaged slightly above the long-term mean for temperature, though it was not as warm as earlier years in this decade. There were an average number of hot days (maximums above 90.0°F/32.0°C) during the summer (Table 1). The lengthening of the growing season noted a reversal in 2008 as a late freeze occurred in May and an early freeze was noted in the first week of October. The trend toward milder winter nights also had a setback in 2008 as an early January and late February cold snap produced several near 0.0°F (-17.8°C) mornings. Cold days (maximums below 32.0°F/0.0°C) also increased from previous years. The significant increase in autumn rainfall was evident with a very wet December. The fall season has shown the most significant rise in precipitation during the last century. While rainfall was above average for the year, the number of excessively wet days was also above normal. Dry spell occurrences were peppered around the winter and the late summer.

Table 1. Summary of 2008 significant climate indicators for Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area. Data from Matamoras (MATP1) and Hawley (HAWP1), PA compared to the 30 year normal from Wilkes-Barre (KAVP), PA.

Metric	2008 Statistics	Comments on Trends
Average Annual Maximum Temperature	57.9-60.0°F (14.4-15.6°C)	Near the 30-year mean of 59.3°F (15.2°C)
Average Annual Minimum Temperature	35.2-37.1°F (1.8-2.8°C)	Below the 30-year mean of 40.4°F (4.7°C)
Hot Days (number of days Tmax≥90.0°F/32.0°C)	6-7 days	Near the 30-year mean of 2-10 days
Cold Days (number of days Tmax≤32.0°F/0.0°C)	29–39 days	Near the 30-year mean of 24–45 days
Winter Minimums (Lowest Temp)	~-2.0°F (-18.9°C)	Near the long-term record of -21.0°F (-29.4°C)
Sub-freezing Nights (number of days Tmin≤-32.0°F/0.0°C)	162-172 days	Below the long-term average of 3-4 days
Cold Winter Nights (number of days Tmin≤-0.0°F/-17.8°C)	0-2 days	Above the long term average of 124 days
Growing Season Length: Days between last spring 32.0°F/0.0°C and first fall 32.0°F/0.0°C	137–150 days	Below the 30-year mean of 166–200 days
Annual Precipitation	49.1–50.6 in (1247-1285 mm)	Above the 30-year mean of 37.6 in (193 mm)
Autumn (Oct, Nov, Dec) Precipitation	12.1-14.1 in (307-358 mm)	Above the long term average of 10 in (254 mm)
Number of days ≥1.0 in (25 mm) rain	12-14	Above the 30-year mean of 7 days
Micro-drought (number of 7+ days without rain)	3-7	Near the long term average of 5 days
Annual Snowfall	24–35 in (61-89 cm)	Below the 30-year mean of 47 in (119 cm)

Introduction

Weather and climate are widely recognized as key drivers of terrestrial and aquatic ecosystems, affecting biotic as well as abiotic ecosystem characteristics and processes. Global and regional scale climatic patterns, trends, and variations are critical to the cycling of elements, nutrients, and minerals through the ecosystems and can deliver pollutants from regional and even global sources (National Assessment Synthesis Team, 2001). These variations and trends influence the fundamental properties of ecologic systems such as soil-water relationships and plant-soil processes and their disturbance rates and intensity. Information obtained from meteorological monitoring will be useful to interpreting and understanding changes in species composition, community structure, water and soil chemistry, and related landscape processes (Marshall and Piekielek, 2007).

The purpose of this report is to provide a concise climate summary for the period from Janaury 1 through December 31, 2008 and to place current patterns and trends in an appropriate historical, regional, and global context (Knight et al, in preparation). It is our intention that this report will satisfy an inherent interest in meteorological phenomena, and meet the Eastern Rivers and Mountains Network (ERMN) Weather and Climate Monitoring objectives:

- Document long-term trends in weather and climate through seasonal and annual summaries of selected parameters (e.g., multiple forms of precipitation, temperature).
- Identify and document extremes and averages of climatic conditions for common parameters (e.g., precipitation, air temperature), and other parameters where sufficient data are available (e.g., wind speed and direction, solar radiation).
- Provide information on near real-time weather parameters, historical climate patterns, and climate station metadata from a single, easy to use Internet portal.

To accomplish this goal, a variety of atmospheric data streams were evaluated for their quality, longevity, and applicability to the ERMN parks. Since no single network contains all the pertinent measures of atmospheric phenomena to assess ecosystem health, an objective analysis of the data networks was developed and outlined in the Weather and Climate Monitoring Protocol for the Eastern Rivers and Mountains and Mid-Atlantic Networks of the National Park Service (Knight et al, in preparation). Through this analysis, a select number of weather/climate stations were chosen as representative of each park and these are the primary data sources used in the profile of last year's climate summary and trends.

In addition to a suite of summary tables, graphs, and narratives, we specifically identify a series of key climatological indicators to report status and trends on an annual basis and periodically in separate and more thorough reports. These key indicators are further described in the protocol (Knight et al, in preparation) and summarized in the body of the text.

Climate of the Pocono Mountains and Eastern Plateau

DEWA lies in Pennsylvania Climate Division 1 "Pocono Mountains" and New Jersey Climate Division 1 "Northern NJ" while UPDE also lies within the PA "Pocono Mountains" Climate Division and Climate Division 2 in New York "Eastern Plateau". These climate divisions are generally considered to have a humid continental type of climate, but the varied physiographic features have a marked effect on the weather and climate of the various parts of the Delaware River valley. The prevailing westerly winds carry most of the weather disturbances that affect the region from the interior of the continent, so that the Atlantic Ocean has limited influence on the climate of the area (Gawtry and Stenger, 2007). Coastal storms do, at times, affect the day-to-day weather, especially in the winter. Also, storms of tropical origin can have the greatest effect within this portion of the Pennsylvania-New Jersey-New York region, causing severe floods in some instances.

Temperatures are moderately continental with the tempering effects of the Great Lakes contributing to cloud production in the winter and onshore winds reducing the heat at times during the summer. The lowest readings in the winter occur with polar air masses of Canadian origin settling over the Northeast after a fresh snowfall. The highest readings of the summer happen when the sub-tropical fair weather system, the Bermuda high, pushes westward into the Carolinas. Its clockwise circulation will direct hot, humid air from the Gulf region into the Delaware River valley. The southwest winds gain additional warmth when descending the crest of the Appalachians. The last freeze typically occurs in May and the first frosts appear in October. On average, Upper Delaware SSR tends to have a greater number of sub-freezing nights than Delaware Water Gap NRA.

Precipitation is fairly evenly distributed throughout the year. Annual amounts generally range between 34–52 inches (864–1320 mm), while the majority of places receive 38–46 inches (965–1168 mm). Greatest amounts usually occur in the late-spring and summer months, while February is the driest month, having about 2.0 inches (51 mm) less than the wettest months. Precipitation tends to be somewhat greater in the mountains, due primarily to coastal storms which occasionally frequent the area. During the warm season these storms can bring heavy rain, while in winter, heavy snow or a mixture of rain, ice and snow may be produced.

Surface winds blow from the west and northwest in the cold season and from the southwest during the warm half of the year. Thunderstorms follow a frequency that matches the solar cycle, occurring between the equinoxes and reaching a peak near the solstice. Hail is relatively infrequent, but flash floods and damaging thunderstorm winds affect parts of the river valley each summer. On average, tornadoes pass through the area about once every three years. The direct effects of an Atlantic hurricane are uncommon, though remnant rains from hurricanes and tropical storms have contributed to the region's worst floods. Ice storms, which can cause significant disruption occur at irregular intervals, but are primarily confined to the months between December and March (Kocin and Uccellini, 2004).

Observing Sites

A total of 24 weather observing sites comprised of six data networks were selected around UPDE and DEWA (Figure 1). Representative stations within a 100 km range of each park were chosen based on several criteria which include proximity to the park, the representativeness of the station to the park elevation profile, the type and frequency of observations, the period of record of the data, and data availability (Knight et al, in preparation). A subset of these observing networks (IFLOWS, GOES, NADP, and CWOP; 9 total observing sites) are not yet utilized for these reports due to limited data availability and/or lack of data quality assurance (Bureau of Land Management, 1997). Moreover, the percentage of time an observing station reports a particular parameters (e.g., temperature) can influence its data inclusion. A total of 9 observing sites were ultimately used for this 2008 report (Table 2).

In addition to the summary information available in this report, a near real-time data stream has been made available to the ERMN through a web interface for the selected observing stations along with monthly, seasonal and annual summaries. The web interface is accessible through the following link:

http://climate.met.psu.edu/gmaps/NPS_DEVELOPMENT/interface.php

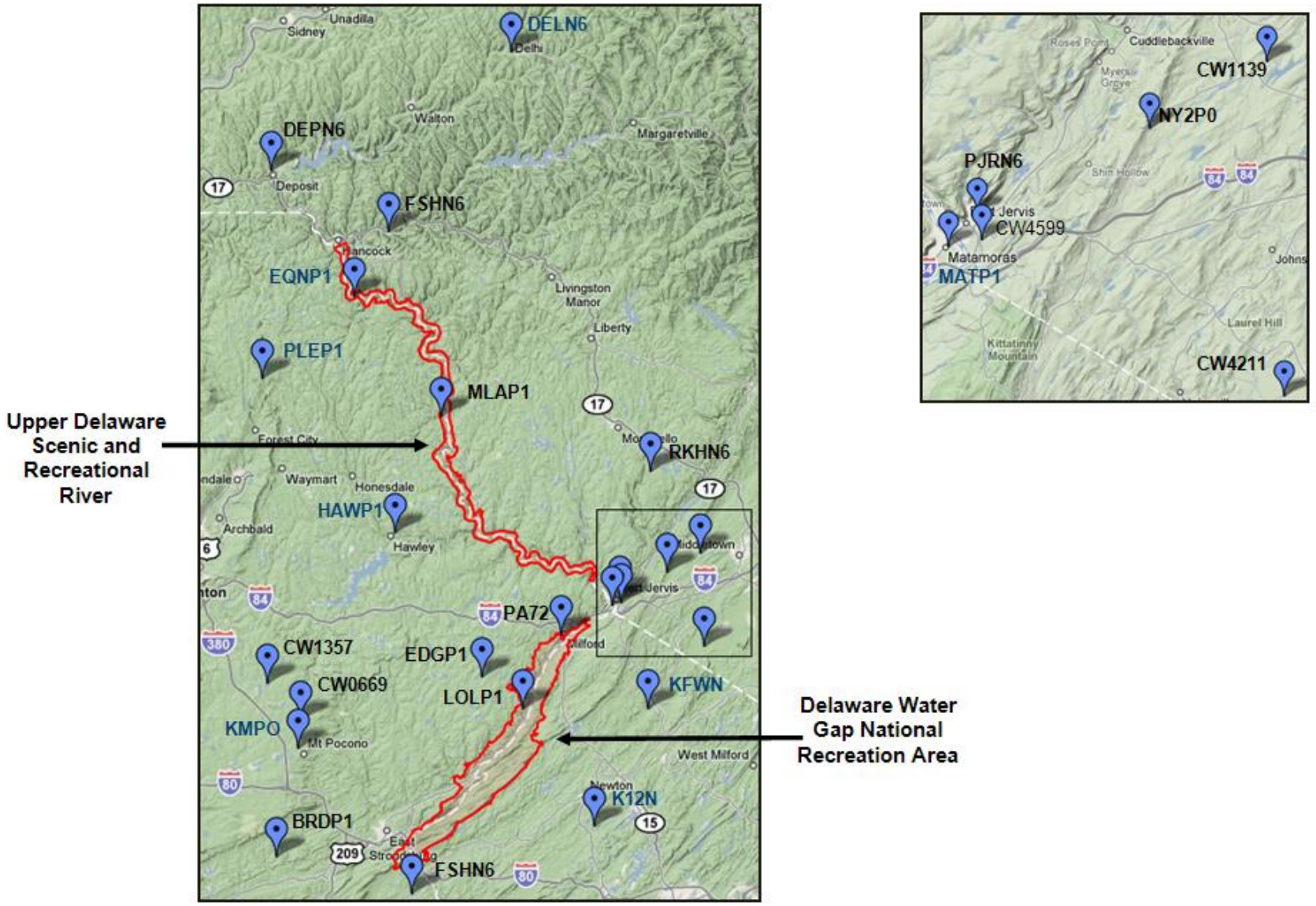


Figure 1. Location of observing sites around the Upper Delaware Scenic and Recreational River and the Delaware Water Gap National Recreation Area.

Table 2. List of thirteen weather/climate reporting sites within the Upper Delaware Scenic and Recreational River and the Delaware Water Gap Recreation Area. Those in bold (9) have been selected as best representative of the parks in 2008, in large part due to the percent time of reporting during 2008. Not all data networks are shown here – missing are: IFLOWS, GOES, NADP, and CWOP because their data is either incomplete or not quality assured.

Stations	Network	Name	Period of Record (POR)		Percentage of Time Reporting Temperature for 2008	Percentage of Time Reporting Precipitation for 2008	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
MATP1	COOP	Matamoras	10/01/1904	Present	**100.0**	**100.0**	39.4	93.7
DELN6	COOP	Delhi 2 SE	01/01/2006	Present	**100.0**	**99.2**	99.5	98.8
DEPN6	COOP	Deposit	01/01/2006	Present	82.7	91.5	80.9	86.3
EQNP1	COOP	Equinunk 2	03/01/1957	Present	-	**100.0**	-	97.6
HAWP1	COOP	Hawley 1 E	11/01/1897	Present	**100.0**	**99.2**	73.3	79.3
MLAP1	COOP	Milanville	08/01/1945	Present	8.2	8.2	19.9	39.6
PJRN6	COOP	Port Jervis	01/01/2006	Present	56.0	56.0	76.1	75.5
PLEP1	COOP	Pleasant Mount 1 W	10/01/1924	Present	**99.7**	**99.7**	66.2	97.1
RKHN6	COOP	Rock Hill 3 SW	11/14/2006	Present	8.5	82.5	27.1	91.9
K12N	FAA	Andover	01/01/2000	Present	**98.1**	**98.1**	72.0	72.1
KMPO	FAA	Mount Pocono	01/01/1999	Present	**96.2**	**96.2**	91.4	91.6
KFWN	FAA	Sussex Airport	01/01/2000	Present	**99.5**	**99.5**	89.2	89.2
LOLP1	RAWS	Loch Lomond	01/01/2005	Present	**98.9**	**98.9**	88.4	88.4

Calendar Year 2008 Temperature Summary

The year averaged above the long-term mean temperature (Table 3), though it was not as warm as earlier years in this decade. The first four months of 2008 were milder than usual with January and April exhibiting the largest departures (Tables 4 and 5; Figures 2 and 3). Pleasant Mount, PA, which is near UPDE, had an average monthly temperature of 24.5°F (4.1°C) for January. This was 5.7°F (3.1°C) above the average (Tables 4 and 5). Several cold episodes brought morning readings to near and below 0.0°F (-17.8°C) during January and February and oddly, the lowest values in many sections were measured on Leap Day (February 29, 2008). The number of sub freezing nights was well above the mean (Table 3).

The spring had alternating warmth and chill with the period April-May-June averaging above the long-term mean. For example, the Pennsylvania Pocono Mountains Climate Division, which encompasses most of UPDE and DEWA, ranked as the 35th warmest (57 is the average; Table 6). However, DEWA also resides in the New Jersey Northern Climate Division, which ranked as the 8th warmest spring since 1895 (Table 7). Several outbreaks of unseasonably cold weather during May brought most sections a late freeze and frost (between May 19-22 and again May 28). Temperatures during May had the largest negative departures with readings between 0.6 and 5.7°F (0.3 and 3.2°C) below normal (Table 5). The highest readings of the year came early when temperatures rose well into the 80°'s to near 90°F (32°C) between June 7 and June 10. This warm period ended with heavy thunderstorms, some producing hail.

The summer period was warmer than average due to higher than normal minimum readings (Figure 3). No record maximums were recorded during July, August and September. A warm spell occurred from July 16-21 and again from September 2-5 preceding tropical storm Hannah. Regular rainfall led to only a few dry spells, though the latter part of August turned quite dry.

Autumn temperatures were near to below average (Tables 4 and 5; Figures 2 and 3). Frosts and freezes occurred earlier than in recent years with most sections noticing sub-freezing readings (<0°C) between October 3-8. Maximum temperatures during November were closer to normal and December brought milder weather with alternating cold and warm spells. A cold snap late in the month did bring some minimums near 0.0°F (-17.8°C).

Overall, the annual temperature for 2008 averaged above normal. Soil temperatures for the year also fit into a similar trend. These values have been on the rise during the past 30 years, which is consistent with the warming trend noted in the lower atmosphere during the past 3 decades (Figure 4). The total growing season length (days between last spring freeze and first fall freeze) ranged from 150-137 days in 2008.

Upper Delaware SSR and Delaware Water Gap NRA
Departure from Average Monthly Maximum Temperature
2008 vs. 1971–2000

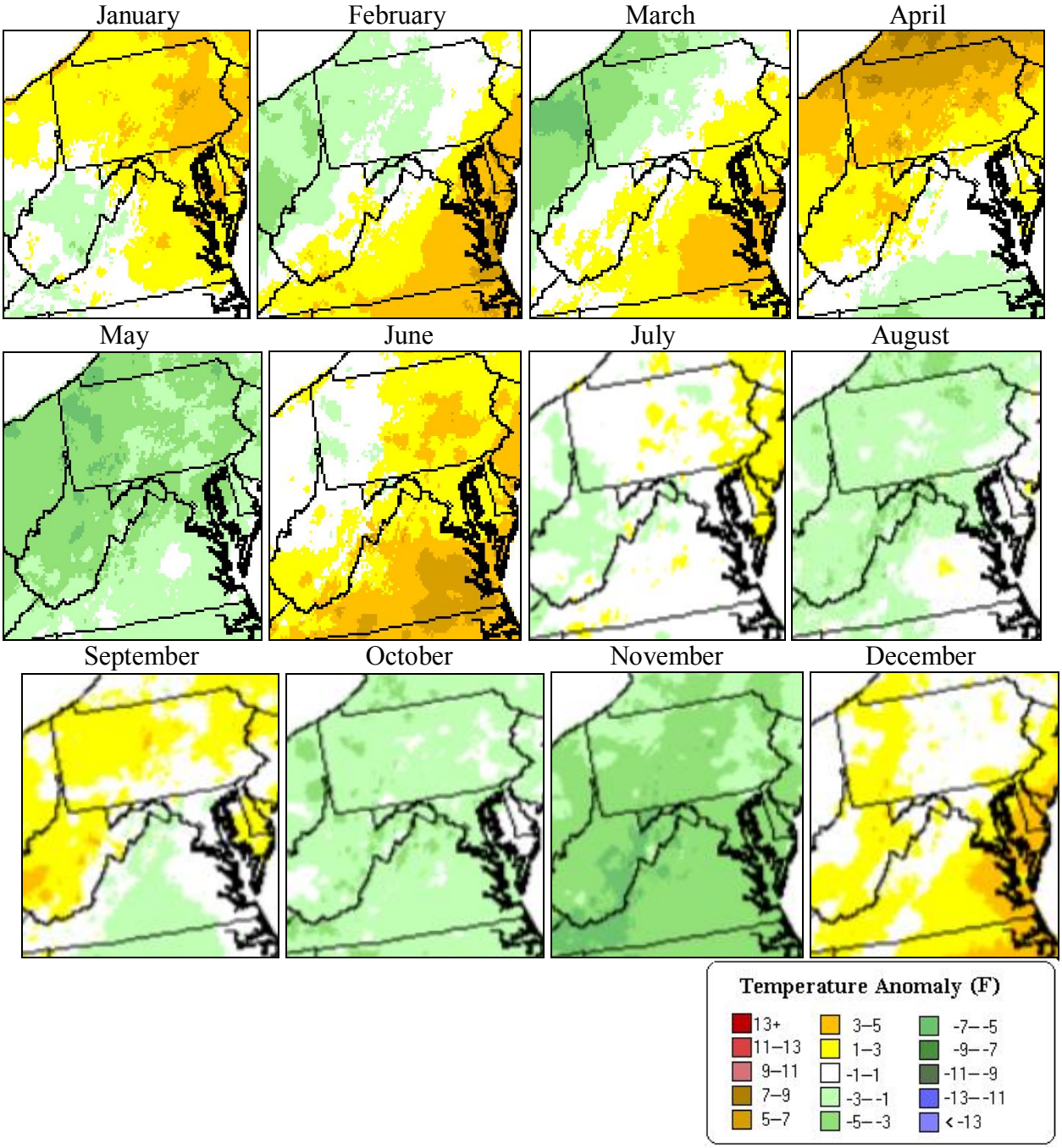


Figure 2. Map showing departures from average maximum daily temperatures (°F) for each month in the calendar year 2008 as compared with the normal based on the period 1971–2000. Maps were created using estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM). PRISM uses an interpolation scheme for temperature between actual observations and corrects these estimates for changes in topography across the region (Daly et al, 2002). More information can be found at http://www.prism.oregonstate.edu/.

Upper Delaware SRR and Delaware Water Gap NRA
Departure from Average Monthly Minimum Temperature
2008 vs. 1971–2000

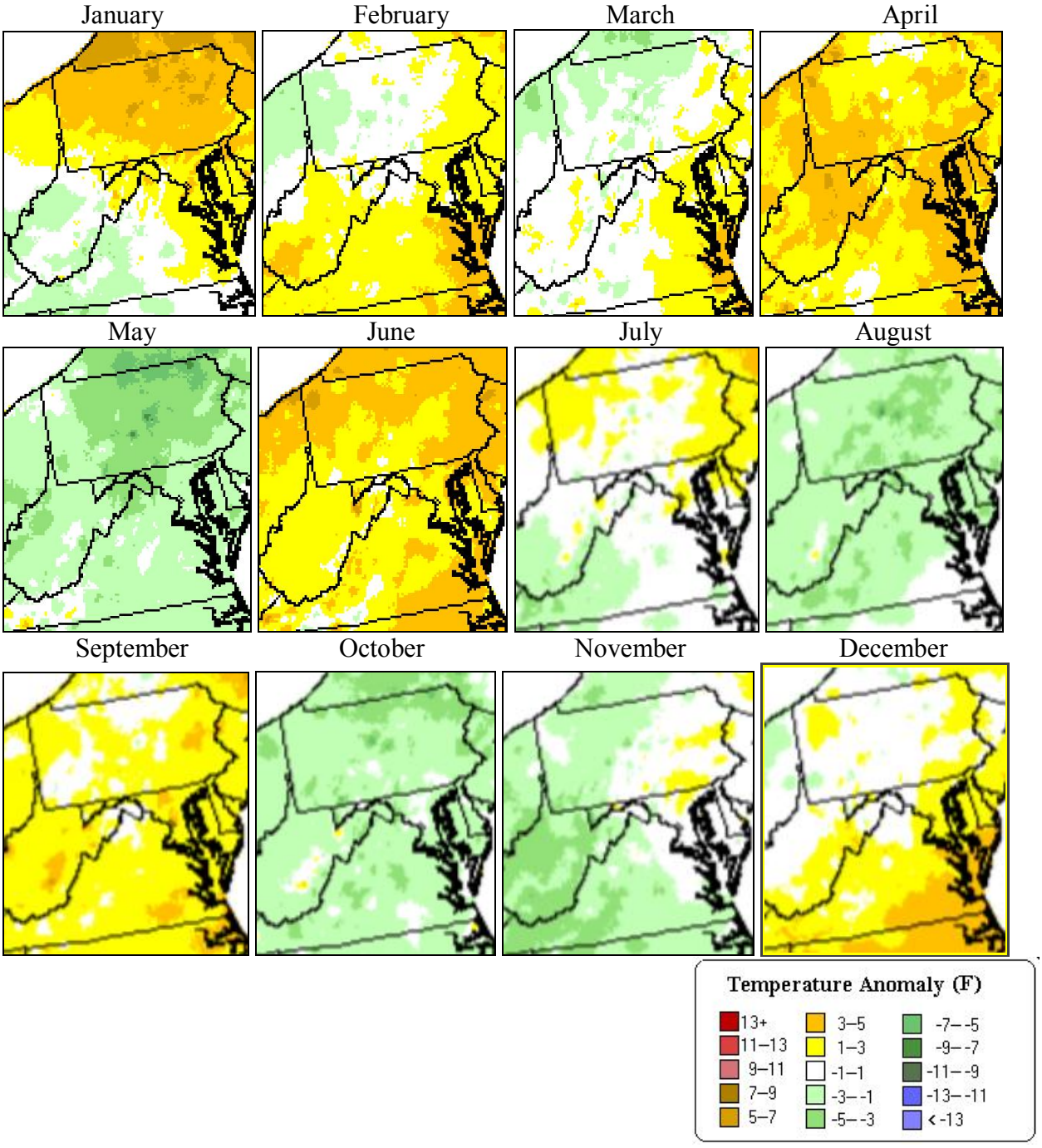


Figure 3. Map showing departures from average minimum daily temperatures (°F) for each month in the calendar year 2008 as compared with the normal based on the period 1971–2000. Maps were created using estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM). PRISM uses an interpolation scheme for temperature between actual observations and corrects these estimates for changes in topography across the region (Daly et al, 2002). More information can be found at http://www.prism.oregonstate.edu/.

Table 3. Temperature indicators of the climate in Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area using COOP sites in Pennsylvania (Matamoras and Hawley) and comparing their 2008 data with a long-standing site at Wilkes-Barre, Pennsylvania. While the elevation does vary, the trend in 2008 showed near average number of cold winter days but a notable increase in the frequency of sub-freezing nights. The summer of 2008 brought fewer than average number of hot days and the length of the growing season was notably shorter than the 30-year average for Wilkes-Barre.

2008 statistics compared with 30-year means	Matamoras, PA (MATP1) 2008	Hawley, PA (HAWP1) 2008	Wilkes-Barre, PA (KAVP) 1971–2000
Average Annual Maximum Temperature	60.0°F (15.6°C)	57.9°F (14.4°C)	59.3°F (15.2°C)
Average Annual Minimum Temperature	37.1°F (2.8°C)	35.2°F (1.8°C)	40.4°F (4.7°C)
Cold Days (number of days with Tmax ≤32.0°F/0.0°F)	29	39	39.1
Sub-freezing Nights (number of days with Tmin ≤32.0°F/0.0°C)	162	172	123.9
Winter Minimums (Lowest Temp.)	2.0°F (-16.7°C)	-2.0°F (-18.9°C)	-21.0°F (-29.4°C)
Summer Maximum (Highest Temp.)	94.0°F (34.4°C)	91.0°F (32.8°C)	Not Available
Cold Winter Nights (number of days with Tmin ≤-0.0°F/-17.8°C)	0	2	3.5
Hot Days (number of days with Tmax ≥90.0°F/32.0°C)	7	6	7.4
Growing Season Length: Number of days between last spring 32.0°F/0.0°C and first fall 32.0°F/0.0°C	150	137	166

Table 4. Summary of monthly average temperatures for 2008 for the reporting sites around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Delhi, NY	DELN6	-4.6 °C 23.7 °F	-4.8 °C 23.4 °F	-1.4 °C 29.5 °F	8.0 °C 46.4 °F	9.6 °C 49.2 °F	18.1 °C 64.5 °F	20.2 °C 68.4 °F	17.6 °C 63.8 °F	16.1 °C 61.0 °F	6.5 °C 43.7 °F	2.1 °C 35.8 °F	-2.1 °C 28.2 °F	7.1 °C 44.8 °F
Hawley, PA	HAWP1	-3.2 °C 26.2 °F	-3.79 °C 25.2 °F	0.7 °C 33.2 °F	8.9 °C 48.1 °F	10.5 °C 50.8 °F	19.3 °C 66.7 °F	21.0 °C 69.9 °F	18.1 °C 64.6 °F	16.3 °C 61.4 °F	7.9 °C 46.3 °F	2.7 °C 36.8 °F	-1.8 °C 28.8 °F	8.1 °C 46.5 °F
Pleasant Mount, PA	PLEP1	-4.1 °C 24.5 °F	-5.3 °C 22.5 °F	-1.6 °C 29.1 °F	7.9 °C 46.2 °F	9.6 °C 49.4 °F	18.5 °C 65.2 °F	19.9 °C 67.8 °F	17.1 °C 62.8 °F	15.3 °C 59.6 °F	6.7 °C 44.1 °F	1.5 °C 34.8 °F	-3.4**a** °C 25.9**a** °F	6.9 °C 44.3 °F
Andover, NJ	K12N	0.6 °C 33.1 °F	0.5 °C 32.8 °F	5.1**b** °C 41.1**b** °F	12.7 °C 54.9 °F	14.3 °C 57.8 °F	22.3 °C 72.1 °F	24.0**d** °C 75.1 °F	20.5 °C 68.9 °F	18.7 °C 65.7 °F	10.2 °C 50.3 °F	6.0°C 42.7 °F	1.7 °C 35.0 °F	11.4 °C 52.5 °F
Mount Pocono, PA	KMPO	-3.00 °C 26.6 °F	-3.8 °C 25.1 °F	0.2 °C 32.4 °F	8.7 °C 47.7 °F	11.0 °C 51.7 °F	18.8 °C 65.9 °F	20.3**b** °C 68.6**b** °F	17.4 °C 63.3 °F	16.0 °C 60.8 °F	7.5 °C 45.5 °F	-0.7**d** °C 30.7**d** °F	-2.5 °C 27.6 °F	7.5 °C 45.5 °F
Sussex, NJ	KFWN	-0.7 °C 30.8 °F	-1.6 °C 29.2 °F	3.0 °C 37.4 °F	11.0 °C 51.8 °F	13.2 °C 55.7 °F	21.0 °C 69.7 °F	22.9 °C 73.1 °F	19.6 °C 67.2 °F	17.6 °C 63.7 °F	9.2 °C 48.5 °F	4.63 °C 40.3 °F	-0.1 °C 31.8 °F	10.0 °C 49.9 °F

a = 1 day missing b = 2 days missing c = 3 days missing d = 4 days missing
Monthly statistics not reported if more than 4 days are missing.

Table 5. Summary of 2008 departure from normal temperature based on 30-year normal (1971–2000) for the reporting sites around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delhi, NY	DELN6	1.5 °C	0.2 °C	-1.7 °C	1.6 °C	-3.2 °C	0.8 °C	0.7 °C	-1.1 °C	1.7 °C	-1.8 °C	-0.8 °C	1.0 °C
		2.8 °F	0.3 °F	-3.1 °F	2.9 °F	-5.7 °F	1.4 °F	1.3 °F	-1.9 °F	3.1 °F	-3.2 °F	-1.4 °F	1.8 °F
Hawley, PA	HAWP1	1.7 °C	0.02 °C	-0.8 °C	1.6 °C	-2.9 °C	1.5 °C	0.8 °C	-1.2 °C	1.3 °C	-1.1 °C	-1.0 °C	0.2 °C
		3.0 °F	0.03 °F	-1.4 °F	2.8 °F	-5.2 °F	2.7 °F	1.4 °F	-2.2 °F	2.3 °F	-2.0 °F	-1.8 °F	0.4 °F
Pleasant Mount, PA	PLEP1	3.1 °C	0.9 °C	-0.4 °C	2.6 °C	-1.9 °C	2.3 °C	1.3 °C	-0.4 °C	2.3 °C	-0.3 °C	0.1 °C	1.0 °C
		5.7 °F	1.6 °F	-0.7 °F	4.7 °F	-3.5 °F	4.1 °F	2.4 °F	-0.7 °F	4.2 °F	-0.5 °F	0.1 °F	1.9 °F
Andover, NJ	K12N	4.5 °C	3.04 °C	0.1 °C	3.9 °C	-0.3 °C	2.9 °C	2.1 °C	-0.1 °C	2.6 °C	-0.5 °C	0.04 °C	2.7 °C
		8.2 °F	5.5 °F	0.1 °F	7.1 °F	-0.6 °F	5.3 °F	3.8 °F	-0.2 °F	4.6 °F	-0.9 °F	0.1 °F	4.8 °F
Mount Pocono, PA	KMPO	2.9 °C	1.2 °C	0.1 °C	2.4 °C	-1.3 °C	2.0 °C	1.0 °C	-0.9 °C	2.1 °C	-0.6 °C	-3.2 °C	0.6 °C
		5.2 °F	2.1 °F	0.2 °F	4.4 °F	-2.3 °F	3.7 °F	1.8 °F	-1.7 °F	3.7 °F	-1.1 °F	-5.8 °F	0.98 °F
Sussex, NJ	KFWN	3.6 °C	1.2 °C	0.4 °C	2.4 °C	-1.3 °C	1.9 °C	1.0 °C	-1.1 °C	1.5 °C	-0.7 °C	0.2 °C	1.0 °C
		6.4 °F	2.1 °F	0.6 °F	4.3 °F	-2.3 °F	3.4 °F	1.9 °F	-2.0 °F	2.6 °F	-1.2 °F	0.4 °F	1.9 °F

Table 6. Using aggregated data from more than a dozen cooperative reporting stations in proximity (within 100 km of the parks) known as PA Climate Division 1, the ranked values indicate a mild and very wet winter followed by a warm, relatively dry spring, a moist and mild summer and a wet and cool autumn.

Climate Division 1 Rankings Pocono Mountains- Pennsylvania	Jan-Feb-Mar WINTER	Apr-May-Jun SPRING	Jul-Aug-Sep SUMMER	Oct-Nov-Dec AUTUMN
Temperature-2008	22	35	33	60
Precipitation-2008	1	72	45	23

1 = Warmest or Wettest 114 = Coldest or Driest

Table 7. Using aggregated data from more than a dozen cooperative reporting stations in proximity (within 100 km of the parks) known as NJ Climate Division 1, the ranked values indicate a mild and very wet winter followed by a warm, relatively dry spring, a moist and mild summer and a wet and cool autumn.

Climate Division 1 Rankings Eastern- New Jersey	Jan-Feb-Mar WINTER	Apr-May-Jun SPRING	Jul-Aug-Sep SUMMER	Oct-Nov-Dec AUTUMN
Temperature-2008	10	8	10	42
Precipitation-2008	14	70	47	25

1 = Warmest or Wettest 114 = Coldest or Driest

Table 8. Using aggregated data from more than a dozen cooperative reporting stations in proximity (within 100 km of the parks) known as NY Climate Division 2, the ranked values indicate a mild and very wet winter followed by a warm, relatively dry spring, a moist and average summer and a wet and cool autumn.

Climate Division 2 Rankings Eastern Plateau- New York	Jan-Feb-Mar WINTER	Apr-May-Jun SPRING	Jul-Aug-Sep SUMMER	Oct-Nov-Dec AUTUMN
Temperature-2008	29	25	69	65
Precipitation-2008	1	74	14	19
	1 = Warmest or Wettest			114 = Coldest or Driest

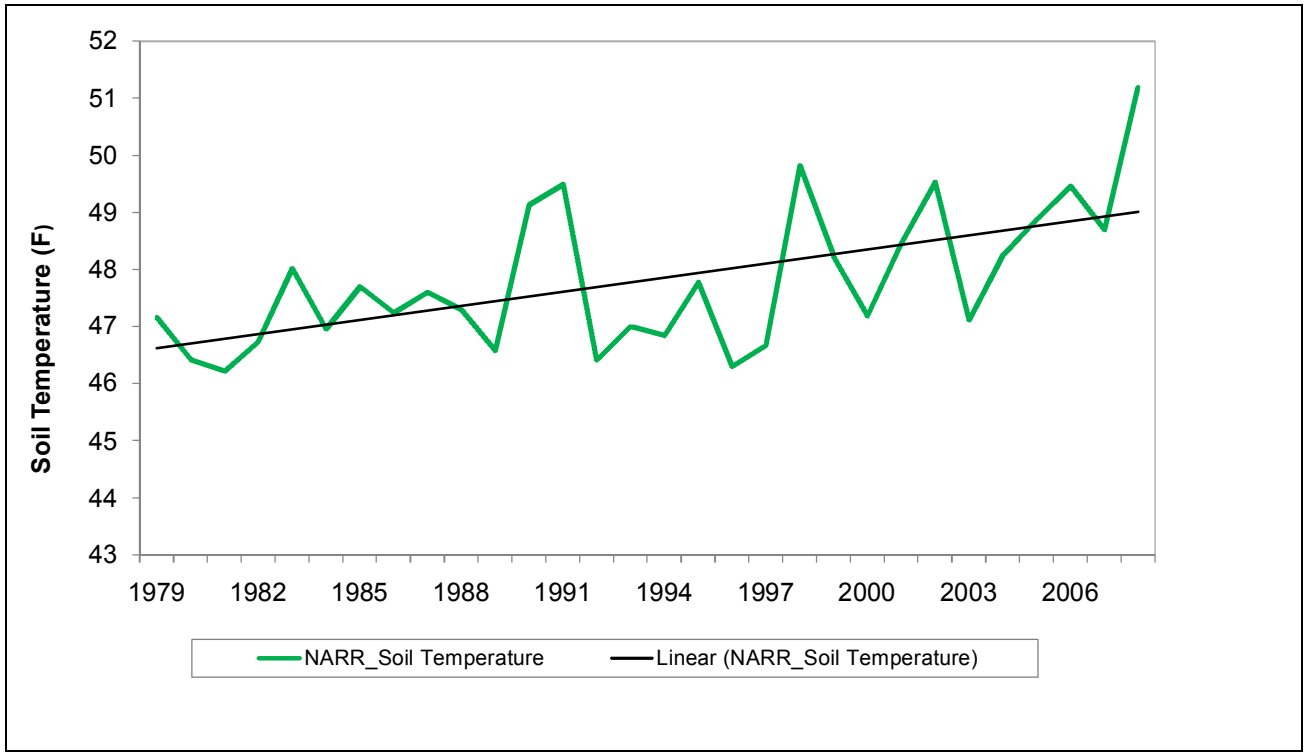


Figure 4. Annual soil temperature trends for Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area as seen from the North American Regional Reanalysis data set. The black line is the soil temperature trend for a 32-km square box centered within Delaware Water Gap National Recreation Area as derived from the North American Regional Reanalysis (NARR). The steady rise is consistent with the warming trend noted in the atmospheric temperatures during the past 30 years.

Growing Degree Days

The derived quantity, growing degree days – base 55°F (12.8°C), is shown for its accumulation and long-term trend during several important intervals of the annual growing season. The accumulation of growing degree days is directly related to the phenological cycle of the flora and fauna and its related pests and diseases. Trends in the growing degree days can signal changes in the exposure of the region's fauna to native and invasive pests. For the Upper Delaware Scenic and Recreational River and the Delaware Water Gap National Recreation Area, a slight decrease is noted for the 'spring' period (Figures 5 and 6) perhaps related to a little cooling during these months in recent decades. However, a warming trend during the summers have more than compensated for the decline earlier in the growing season (Figure 7).

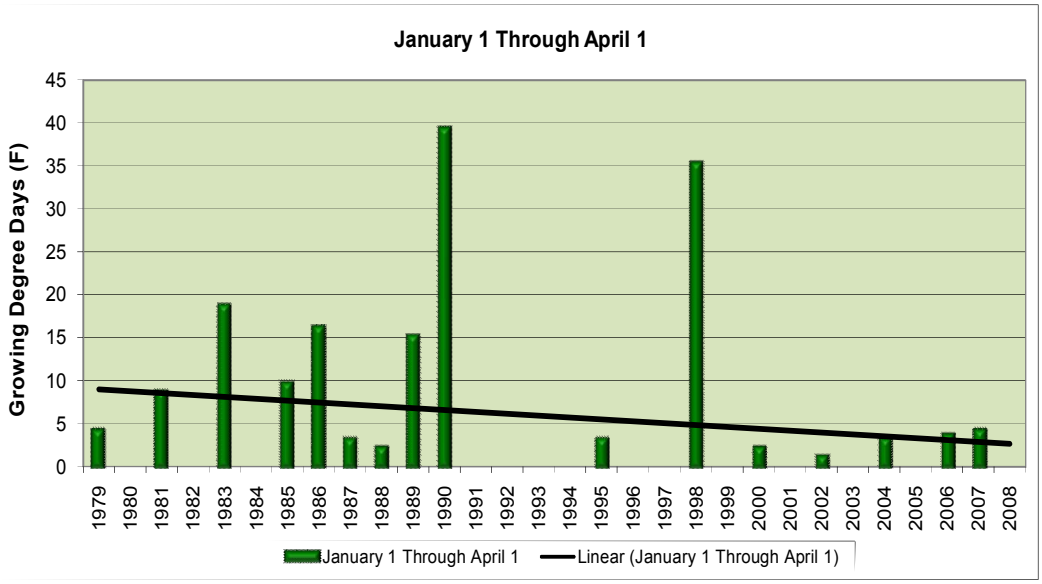


Figure 5: The accumulation of growing degree days for the Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area cooperative reporting stations based on a 90 day period from January 1 to April 1 each year. There is no clear indication of a progressively earlier start to the growing season.

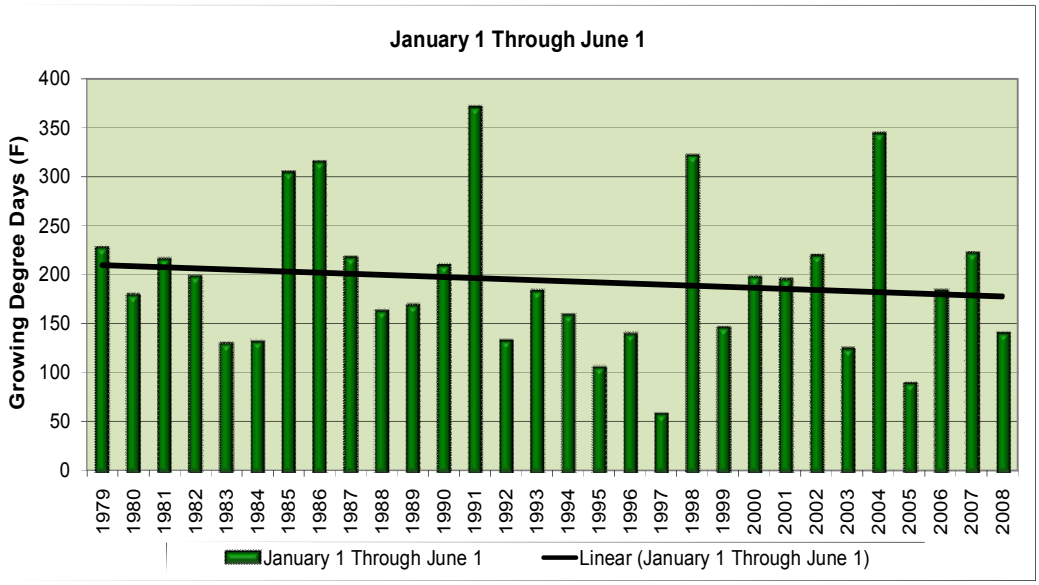


Figure 6: The accumulation of growing degree days for the Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area cooperative reporting stations based on a 150 day period from January 1 to June 1 each year. There is slight downward trend during the last 30 years with a decrease of approximately 10%.

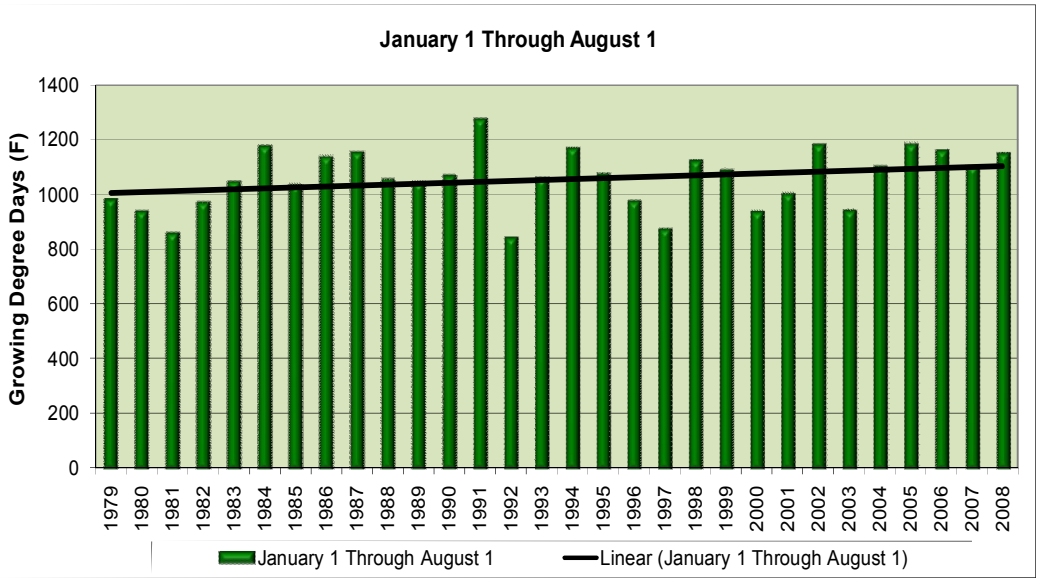


Figure 7: The accumulation of growing degree days for the Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area cooperative reporting stations based on the majority of the growing season (215 days). There is a small increase, approximately 10% during the last 30 years which more than offsets the spring decrease seen in Figure 6.

Calendar Year 2008 Precipitation Summary

For the eighth consecutive year, annual precipitation for the region averaged above the long-term mean (Table 9). In keeping with the trend of recent years, the majority of the wettest days occurred during the colder half of the year (Table 10). The months of February, March, September, October and December averaged above normal precipitation throughout the region (Table 11). Oddly, the highest accumulated liquid occurred in February and December. For example, Equinunk, PA, which is located near UPDE, accumulated 6.0 inches (151 mm) during February and 4.9 inches (125 mm) in December (Table 12). Dry spells were noted in August and September, which is typical, but also in January and April. Snowfall was well below normal due to a persistent wintertime storm track into the Great Lakes which frequently brought mild, moist air into the region. The number of days with excessive rainfall (>1.0 inches/25 mm) were nearly double the long-term average for northeastern Pennsylvania (Table 9).

The winter was quite moist, though January only averaged approximately 70% of normal precipitation (Figure 8). February and March produced between 142-285% of the usual rain/snow fall (Table 10). The wettest period occurred during the first week of March (4-8) when many sections tallied more than 4.0 inches (100 mm) of liquid equivalent which raised the monthly tally to near or above 6 inches (150mm) for most sections (Table 12).

Spring 2008 (April-May-June) was drier than normal with none of the months tallying above average rainfall (Figure 8). A 12 day dry spell was noted during the second half of April (Table 10). The most organized severe storms took place on June 10th as hail and high winds affected parts of the upper Delaware River valley.

The summer brought above average rainfall with two contributions from tropical storms in September. Hannah brought heavy rain (between 1.0-2.0 inches/25-50 mm) on September 6 and the indirect effects of Hurricane Kyle deposited more rain (between 2.0-4.0 inches/50-100 mm) on September 26-28. Despite these rainstorms, an 11 day dry spell occurred between these bouts of tropical moisture (Table 12).

The autumn was wetter than normal due to a moist October and December (Tables 6, 7, and 8). November was quite dry with most sections averaging less than 60% of the normal rainfall (Table 11). An unusually early heavy wet snow fell on the higher elevations on October 28. A series of storms brought a wintry mixture to the region from December 10-24. Freezing rain glazed many sections just before Christmas. The above average precipitation sustained the soil moisture which remained slightly elevated compared with 30 years ago (Figure 9).

Upper Delaware SRR and Delaware Water Gap NRA
Percent of Average Monthly Precipitation
2008 vs. 1971–2000

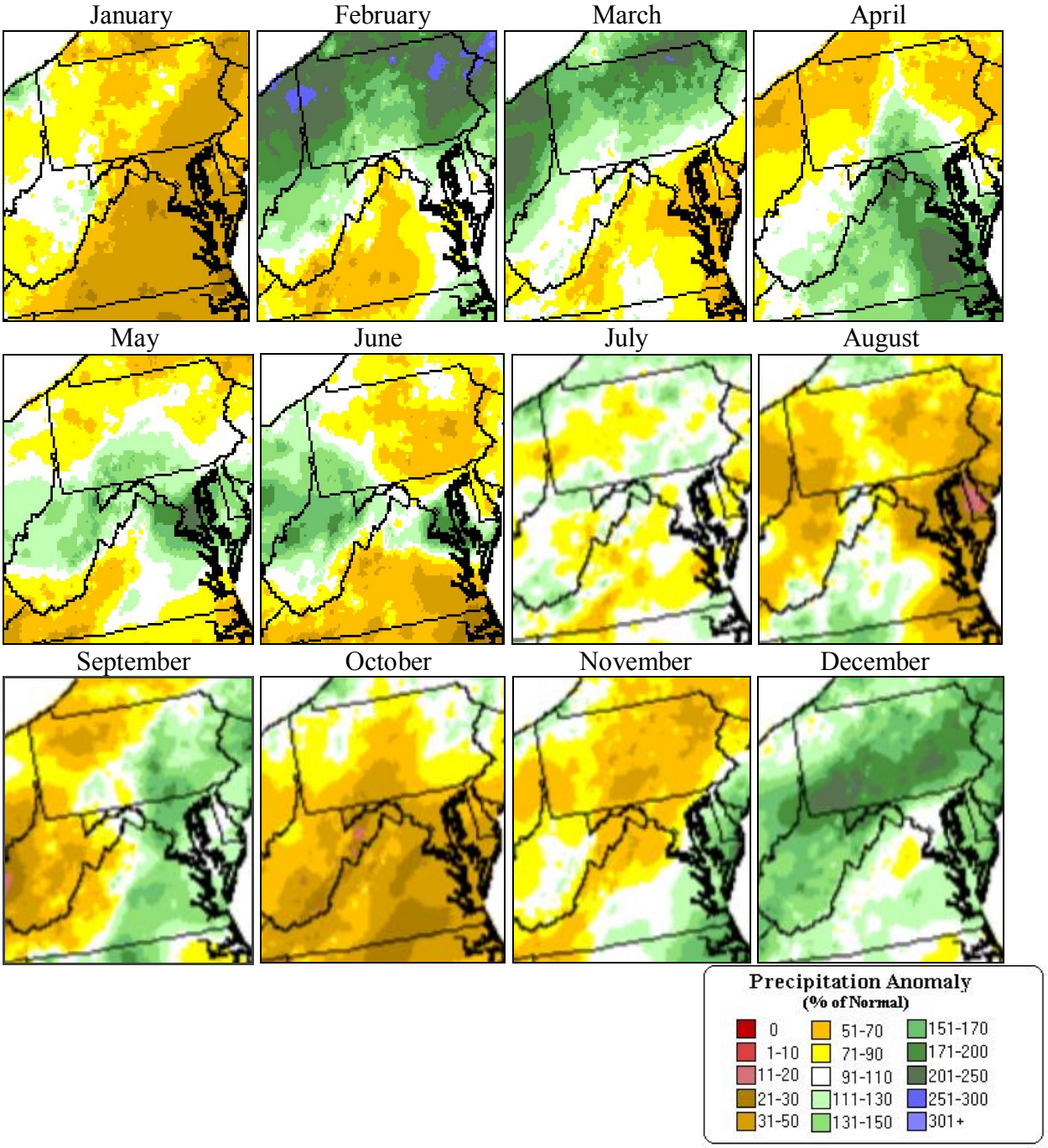


Figure 8. Maps showing percent of average precipitation for each month in the calendar year 2008 as compared with the normal based on the period 1971-2000. Departure values are reported in percent of normal. Maps were created using estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM). PRISM uses an interpolation scheme for precipitation between actual observations and corrects these estimates for changes in topography across the region (Daly et al, 1994). More information can be found at: http://www.prism.oregonstate.edu/ .

Table 9. Precipitation indicators of the climate using COOP sites in Pennsylvania (Matamoras and Hawley) and comparing their 2008 data with a long-standing site at Wilkes-Barre, Pennsylvania. While elevation does vary, trends in 2008 showed an increase in annual rainfall and the number of excessively wet days.

2008 Statistics compared with 30-year means	Matamoras, PA (MATP1) 2008	Hawley, PA (HAWP1) 2008	Wilkes-Barre, PA (KAVP) 1971–2000
Annual Precipitation in inches (millimeters)	50.6 (1285)	49.1 (1247)	37.6 (193)
Autumn (Oct, Nov, Dec) Precipitation in inches (millimeters)	14.1 (358)	12.1 (307)	-
Annual snowfall in inches (centimeters)	35 (89)	24 (61)	47 (119)
Micro-drought (number of strings of 7+ days without rain)	5	5	-
Number of days ≥1.0 inches (25mn) rain	14	12	6.9
Heavy Rain (number of days ≥2.0 inches (51 mm) rain)	3	1	-
Number of days with ≥0.1 inches (0.3 cm) snow	32	26	-
Number of days with ≥1.0 inches (2.5 in) snow	9	11	13.0

Table 10. A comparison of wettest single calendar days during 2008 with the longest periods with a trace or less of rainfall "Dry Spells" during the same year for reporting sites around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area.

Wettest Days in 2008	Dry Spells in 2008
Dec. 12: 2.7 in (69 mm)	Apr. 15–26
Jul. 14: 2.6 in (67 mm)	Jan. 19–29
Oct. 26: 2.2 in (56 mm)	Sept. 15–25
Mar. 5: 2.1 in (53 mm)	Aug 17–24

Table 11. Summary of 2008 percent of normal precipitation based on 30-year normal (1971–2000) for reporting sites around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Matamoras, PA	MATP1	42	270	166	81	71	65	114	43	126	148	61	208	116
Delhi, NY	DELN6	94	285	239	62	78	63	231	86	105	126	56	186	134
Hawley, PA	HAWP1	48	245	186	77	82	80	81	135	153	125	43	221	123
Pleasant Mount, PA	PLEP1	87	196	187	74	81	75	144	54	101	103	46	178	111
Equinunk, PA	EQNP1	81	215	185	70	75	104	154	73	111	122	50	142	115
Andover, NJ	K12N	35	241	155	57	92	57	76	41	146	114	67	170	99
Mount Pocono, PA	KMPO	40	147	142	49	68	75	73	60	143	111	34	134	89
Sussex, NJ	KFWN	21	224	147	55	66	46	72	94	122	95	53	124	90

Table 12. Summary of 2008 monthly total precipitation (in/mm) for reporting sites around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Matamoras, PA	MATP1	1.5 in 37 mm	7.9 in 201 mm	5.9 in 150 mm	3.4 in 85 mm	3.0 in 76 mm	2.9 in 73 mm	4.7 in 120 mm	1.6 in 40 mm	5.7 in 145 mm	5.01in 127 mm	2.3 in 57 mm	6.8 in 173 mm	50.6 in 1285 mm
Delhi, NY	DELN6	2.8 in 70.mm	7.0**a** in 177**a** mm	8.2 in 208 mm	2.4 in 61 mm	3.4 in 85 mm	2.8 in 71 mm	8.9 in 225 mm	2.9 in 72 mm	4.2 in 106 mm	4.7 in 119 mm	2.2 in 55 mm	5.7**a** in 145**a** cm	54.9 in 1395 mm
Hawley, PA	HAWP1	1.5 in 38 mm	6.6 in 169 mm	5.8in 147 mm	2.9 in 74 mm	3.3 in 84 mm	3.4 in 86 mm	2.9 in 74 mm	4.7 in 120 mm	5.8 in 147 mm	3.9 in 99 mm	1.6 in 40 mm	6.6 in 167 mm	49.1 in 1246 mm
Pleasant Mount, PA	PLEP1	3.0 in 76 mm	5.8 in 147 mm	6.5 in 165 mm	3.1 in 79mm	4.01in 102 mm	3.7 in 93 mm	6.3 in 160 mm	2.2 in 57 mm	4.6 in 116 mm	4.3 in 109 mm	2.0**a** in 51**a** mm	6.3 in 159 mm	51.7 in 1312 mm
Equinunk, PA	EQNP1	2.8 in 70 mm	6.0 in 151 mm	6.7 in 171 mm	2.6 in 65 mm	3.0 in 77 mm	4.2 in 106 mm	5.9 in 149 mm	2.7 in 69 mm	4.4 in 112 mm	4.2 in 107 mm	2.0 in 52 mm	4.9 in 125 mm	49.4 in 1256 mm
Andover, NJ	K12N	1.2 in 32 mm	6.8 in 172 mm	5.8**b** in 147**b** mm	2.3 in 59 mm	4.1 in 103 mm	2.6 in 66 mm	3.4**d** in 85**d** mm	1.8 in 47 mm	6.5 in 166 mm	4.1 in 104 mm	2.5 in 64 mm	5.7 in 144 mm	44.8 in 1138 mm
Mount Pocono, PA	KMPO	1.6 in 41 mm	5.0 in 127 mm	5.7 in 146 mm	2.1 in 54 mm	3.2 in 82 mm	3.4 in 87 mm	3.0**b** in 76**b** mm	2.4 in 61 mm	7.1 in 180 mm	4.2 in 105 mm	1.4**d** in 37**d** mm	4.6 in 118 mm	43.8 in 1112 mm
Sussex, NJ	KFWN	0.8 in 21 mm	6.9 in 175 mm	5.6 in 143 mm	2.4 in 62 mm	3.0 in 75 mm	2.1 in 54 mm	3.0**b** in 77**b** mm	4.0 in 102 mm	5.4 in 137 mm	3.5 in 90 mm	2.0 in 50 mm	4.4 in 111 mm	43.1 in 1095 mm

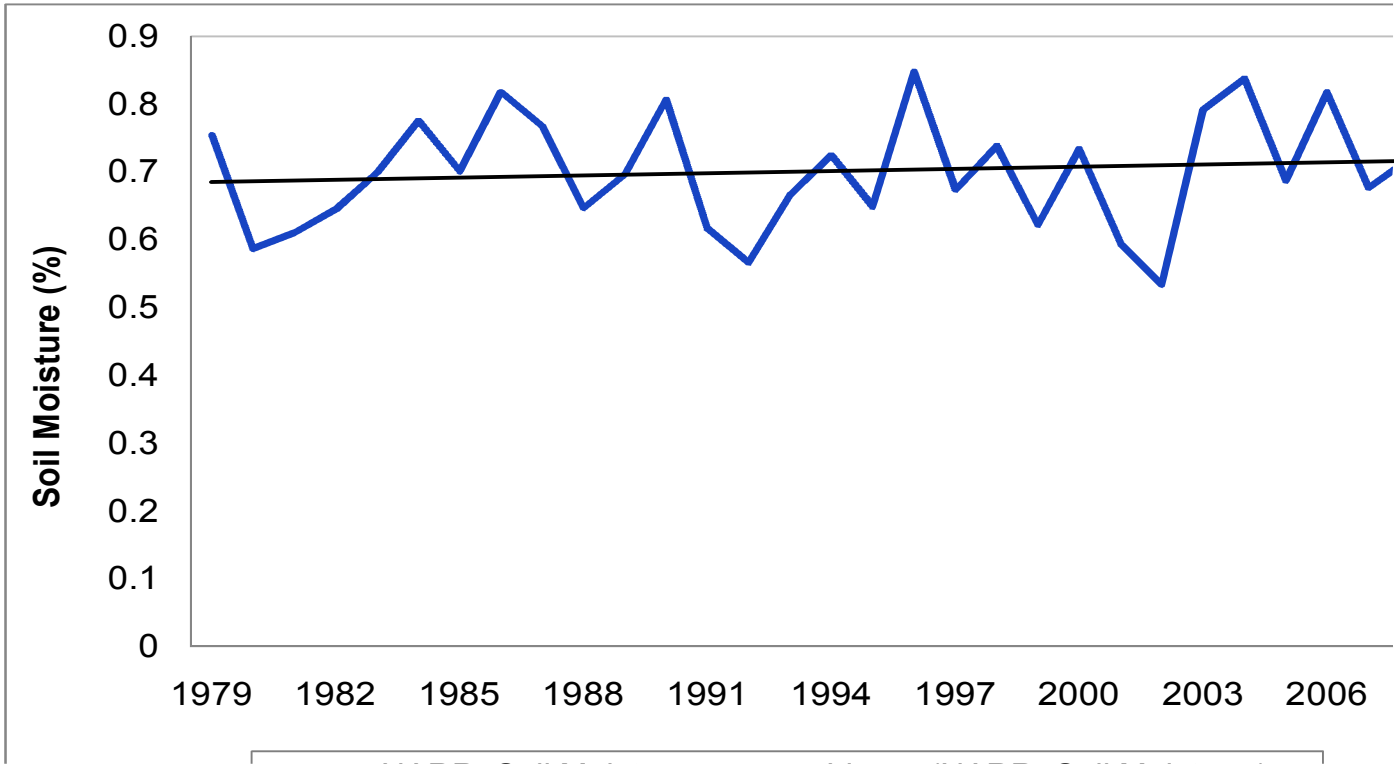


Figure 9. Annual soil moisture trends for UPDE/DEWA as seen from the North American Regional Reanalysis data set. The black line is the soil moisture trend for a 32-km square box within DEWA as derived from the North American Regional Reanalysis (NARR). There has been only a slight upward trend in the soil moisture content during the last 30 years.

Stream Flow for 2008

The USGS maintains river level and flow monitoring gauges along the Delaware and Flat Brook Rivers. Of course, there is a response time between rainfall, snow-melt and changes in the river conditions. There is also seasonality to the river flow with peak flows typically occurring in the spring and minimum flow being measured in the autumn (Groisman et al, 2000). However, reservoir releases have overridden much of this seasonality along the Delaware River. Three gauges were selected to profile river level and stream flow during the calendar year 2008 and these are displayed in Figures 10-12.

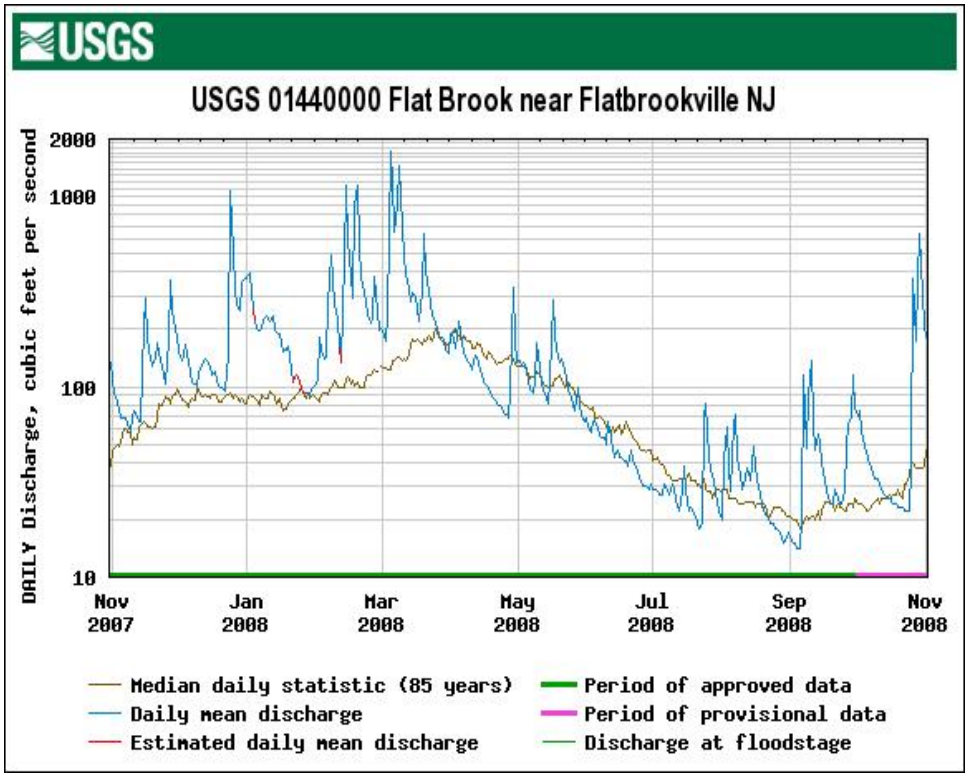
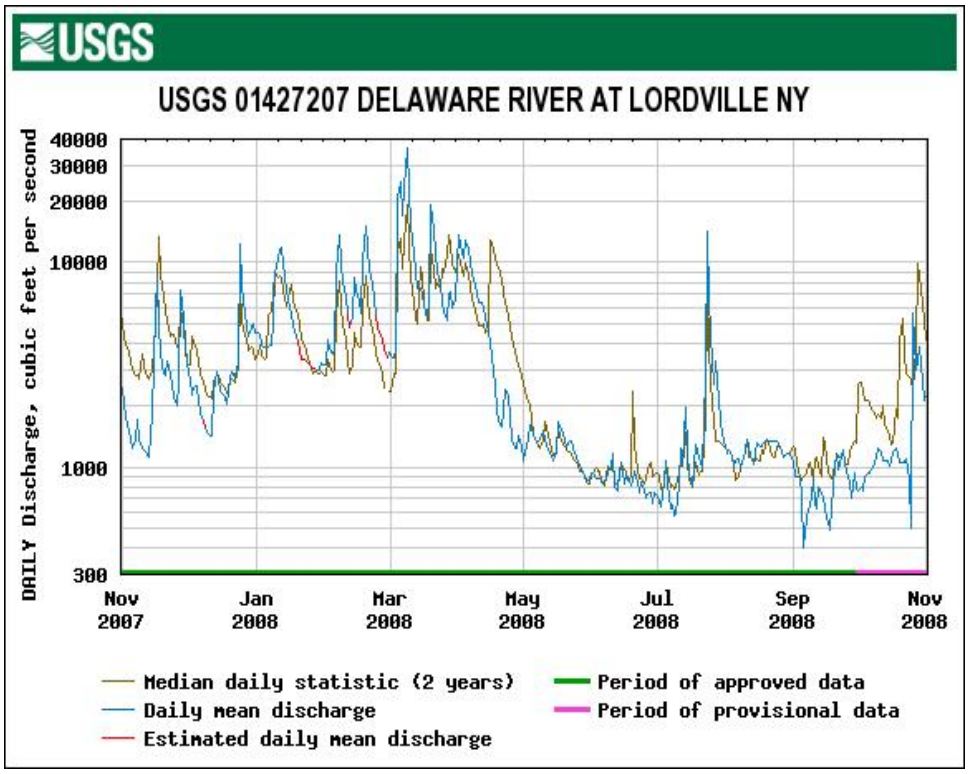
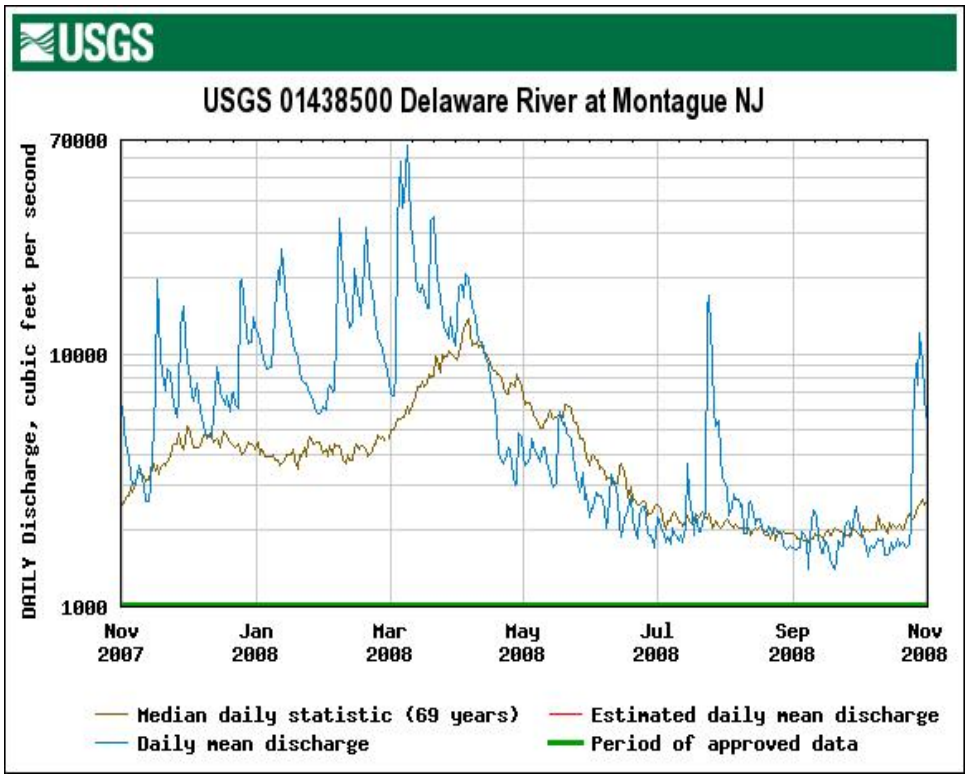


Figure 10: The Flat Brook flows through the Delaware Water Gap National Recreation Area. Below normal discharge can be seen beginning in late April and extending into mid-July. The heavy rains associated with two tropical systems in September caused above average flow rates.





Figures 11 and 12. The flows of the Delaware River near the upstream section of Upper Delaware Scenic and Recreational River (Lordville; top) and in Delaware Water Gap National Recreation Area (Montague; bottom). The effects of a wet winter and then a dry spring and early summer and wet late autumn are notable at Montague.

Drought Status

The U.S. Drought Monitor (USDM; http://www.drought.unl.edu/dm/monitor.html) tracks drought conditions across the nation on a weekly basis, and it incorporates data and expert input from a wide variety of state and federal agencies. The USDM is designed to represent a "broad brush," regional perspective on drought, and therefore provides an ideal tool for tracking generalized drought conditions across the Delaware River valley parks and surrounding areas (Figure 13–15). According to the USDM, there was no time during the year when it was drier than normal. In fact, despite some dry periods in April, August and November, most of the time, the region was abnormally moist (> +2). When compared with the past few years, 2008 was noticeably moister than 2007 and very similar to 2006. The Palmer Drought Severity Index (PDSI) uses temperature and rainfall information in a formula to determine dryness. Since the PDSI responds to long-term effects, including evaporation, there is usually a lag between both long dry spells and episodes of heavy rain and changes in the index value.

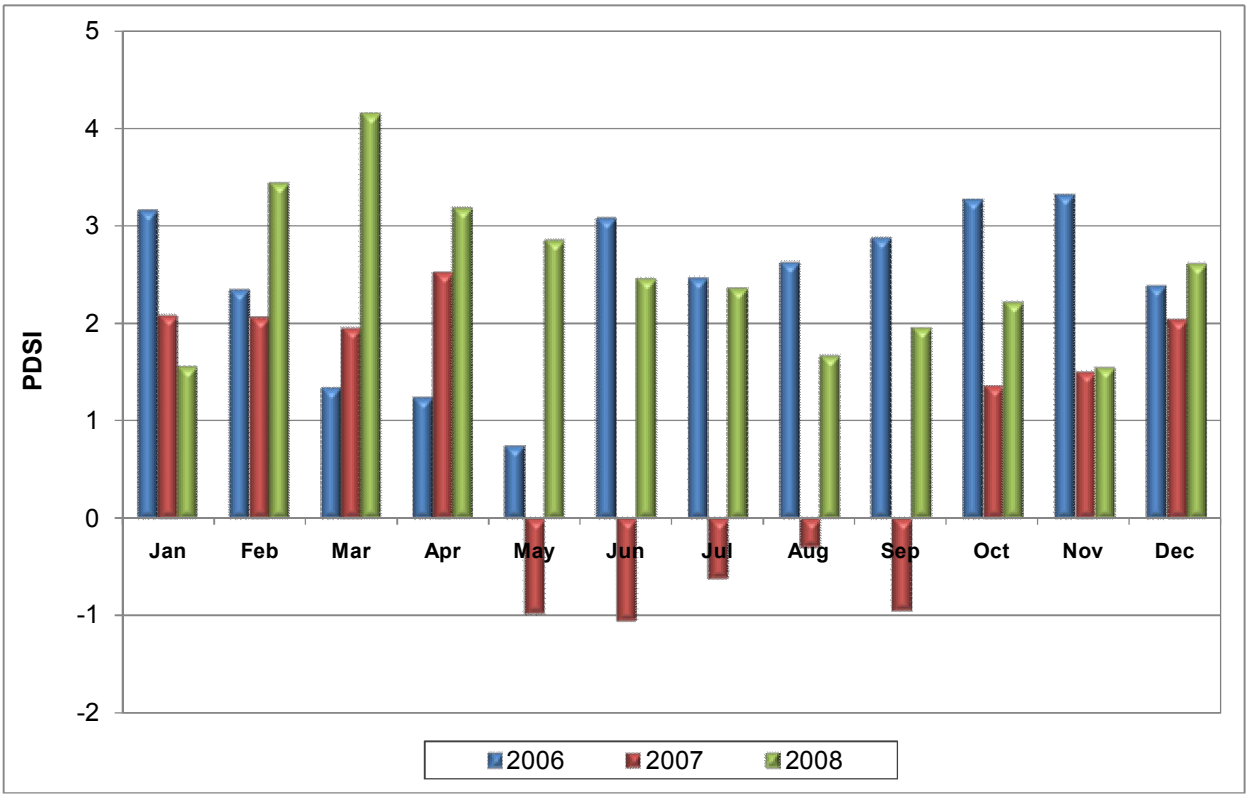


Figure 13. A comparison of the Palmer Drought Severity Index (PDSI) for the Pennsylvania Climate Division 1, which encompasses most of UPDE and the majority of DEWA. The PDSI during 2008 was consistently above normal indicating moist conditions for the year (the long-term average value is zero).

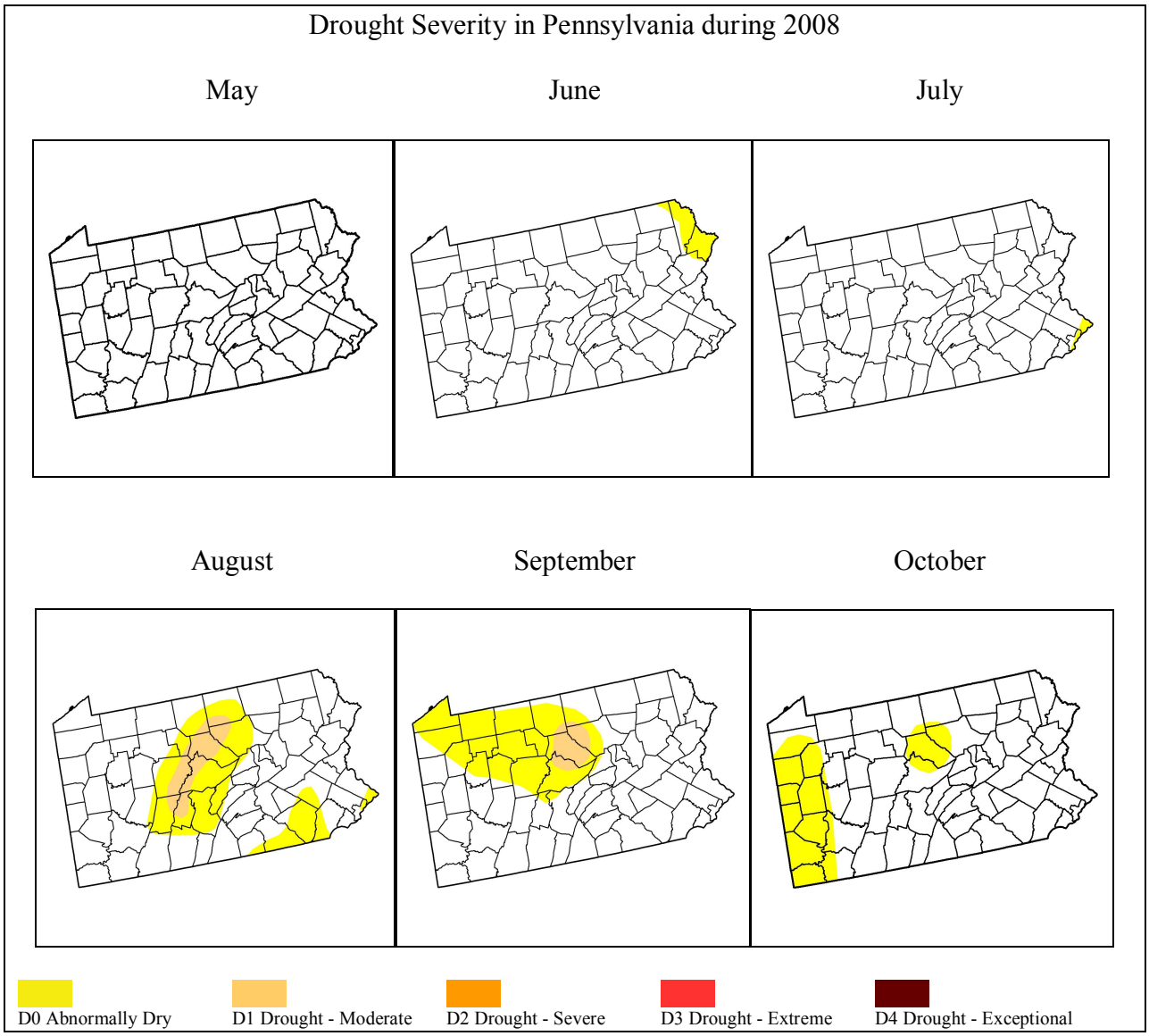


Figure 14. The mid-month values of the PDSI for Pennsylvania showing that dry conditions rarely encroached on the Delaware Parks. Only June was drier than normal in this region.

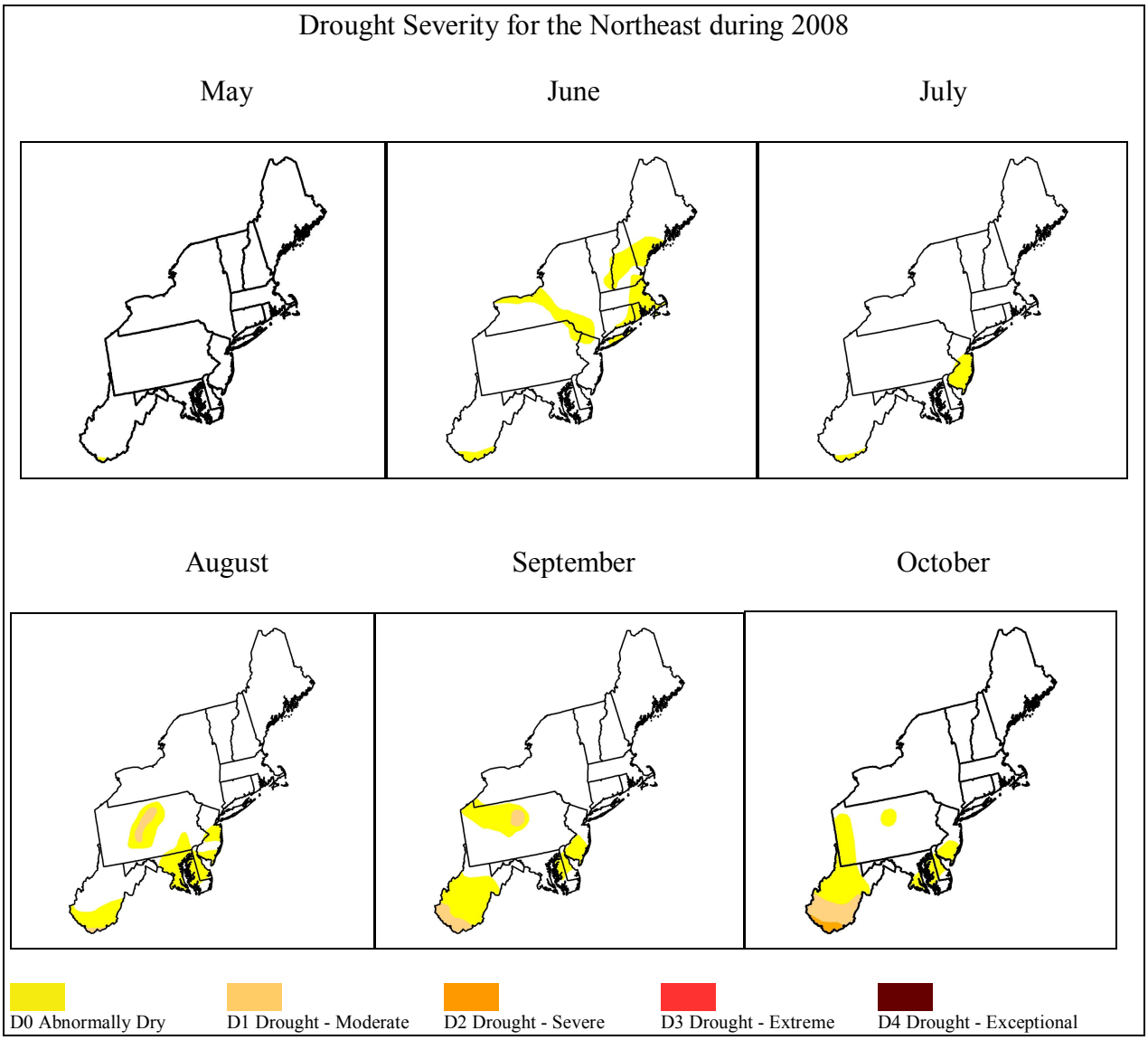


Figure 15. The mid-month values of the PDSI for the Northeast during the 2008 warm season. Southern New Jersey was the most consistently dry region.

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Appendix.

The following tables are a tally of all reports of severe weather during 2008 in the counties that encompass UPDE and DEWA. These storm events were provided by the National Climatic Data Center (NCDC). NCDC receives this storm data from the National Weather Service, who acquires their information from a variety of sources. These sources include but are not limited to: county, state, and federal emergency management officials, local law enforcement officials, skywarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry, and the general public. This Storm Data is an official publication of the National Oceanic and Atmospheric Administration (NOAA) which documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Each table contains the location, date, time, description of the severe event, its magnitude, and number of deaths, injuries, and property/crop damage associated with the event. The property and crop damage should be considered as a broad estimate.

Pike County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ048 - 072	2/22/2008	1:00 AM	Winter Storm	N/A	0	0	0K	0K
Milford	4/1/2008	19:45 PM	Hail	0.75 in.	0	0	0K	0K
Dingmans Ferry	4/1/2008	19:46 PM	Hail	0.75 in.	0	0	0K	0K
Bushkill	4/1/2008	19:50 PM	Thunderstorm Wind	50 kts.	0	0	1K	0K
Millrift	4/1/2008	19:55 PM	Hail	0.75 in.	0	0	0K	0K
Milford	6/7/2008	17:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Paupack	6/8/2008	18:35 PM	Hail	1.00 in.	0	0	0K	0K
Bushkill	6/10/2008	18:49 PM	Hail	1.25 in.	0	0	0K	0K
Greentown	7/27/2008	14:46 PM	Hail	1.00 in.	0	0	0K	0K
PAZ038>040 - 043>044 - 047>048 - 072	12/19/2008	9:00 AM	Heavy Snow	N/A	0	0	0K	0K
				Totals:	**0**	**0**	**1K**	**0K**

Mag:	Magnitude
Dth:	Deaths
Inj:	Injuries
PrD:	Property Damage
CrD:	Crop Damage

Monroe County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ054 - 055	1/1/2008	5:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	1/9/2008	9:00 AM	Strong Wind	41 kts.	0	0	1K	0K
PAZ054 - 055	1/11/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	1/13/2008	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	1/29/2008	20:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/1/2008	7:00 AM	Winter Storm	N/A	0	0	0K	0K
PAZ054 - 055	2/4/2008	12:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/5/2008	12:00 AM	Dense Fog	N/A	0	0	0K	0K
PAZ054 - 055	2/9/2008	8:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/10/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/10/2008	14:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/11/2008	3:00 AM	Cold/wind Chill	N/A	0	0	0K	0K
PAZ055	2/17/2008	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/26/2008	8:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2/29/2008	16:00 PM	Winter Weather	N/A	0	0	0K	0K
Blakeslee	3/5/2008	12:00 AM	Heavy Rain	N/A	0	0	0K	0K
PAZ054 - 055	3/18/2008	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	3/31/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
Mountainhome	4/1/2008	19:25 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
PAZ054 - 055	4/3/2008	22:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ055 - 060	4/23/2008	17:00 PM	Wildfire	N/A	0	0	0K	0K
Swiftwater	5/31/2008	17:15 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Skytop	6/4/2008	15:35 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Tobyhanna	6/10/2008	17:05 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Saylorsburg	6/10/2008	18:10 PM	Thunderstorm Wind	52 kts.	0	0	25K	0K
East Stroudsburg	6/10/2008	18:17 PM	Hail	1.25 in.	0	0	0K	0K
Cresco	6/14/2008	14:30 PM	Flash Flood	N/A	0	0	0K	0K
Tobyhanna	6/14/2008	16:55 PM	Lightning	N/A	1	3	0K	0K
Swiftwater	6/14/2008	17:15 PM	Lightning	N/A	0	0	1K	0K
Robin Hood Lakes	6/14/2008	18:30 PM	Flash Flood	N/A	0	0	0K	0K
Scot Run	6/16/2008	16:35 PM	Hail	0.75 in.	0	0	0K	0K
Stroudsburg	6/16/2008	16:45 PM	Thunderstorm Wind	52 kts.	0	0	25K	0K
Bossardsville	8/2/2008	17:10 PM	Hail	0.75 in.	0	0	0K	0K
Pocono Pines	8/10/2008	13:35 PM	Hail	1.00 in.	0	0	0K	0K
Bossardsville	8/15/2008	14:15 PM	Flash Flood	N/A	0	0	0K	0K
Paradise Vly	9/9/2008	7:50 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Skytop	10/25/2008	13:00 PM	Heavy Rain	N/A	0	0	0K	0K
PAZ055	10/27/2008	21:00 PM	Heavy Snow	N/A	0	0	0K	0K
PAZ054 - 055	11/24/2008	17:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	11/30/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	12/1/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	12/10/2008	23:00 PM	Winter Storm	N/A	0	0	0K	0K
Long Pond	12/11/2008	14:00 PM	Heavy Rain	N/A	0	0	0K	0K
PAZ054 - 055	12/16/2008	19:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	12/19/2008	8:30 AM	Winter Storm	N/A	0	0	0K	0K
PAZ054 - 055	12/22/2008	12:00 AM	Cold/wind Chill	N/A	0	0	0K	0K
PAZ054 - 055	12/24/2008	21:00 PM	Strong Wind	43 kts.	0	0	1K	0K
PAZ054 - 055	12/26/2008	16:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	12/30/2008	2:00 AM	Strong Wind	40 kts.	0	0	0K	0K
PAZ054 - 055	12/31/2008	8:00 AM	Winter Weather	N/A	0	0	0K	0K
				Totals:	**1**	**3**	**52K**	**0K**

Sussex County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012 - 015 - 019	1/9/2008	10:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ001	1/13/2008	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 008	1/17/2008	16:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	1/29/2008	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	1/29/2008	22:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	1/30/2008	9:00 AM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001 - 007	2/1/2008	7:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007	2/1/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 009	2/5/2008	3:00 AM	Dense Fog	N/A	0	0	0K	0K
NJZ001	2/9/2008	9:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2/10/2008	12:00 PM	High Wind	52 kts.	0	0	25K	0K
NJZ001 - 007>010 - 012	2/10/2008	12:00 PM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001	2/11/2008	3:00 AM	Cold/wind Chill	N/A	0	0	0K	0K
NJZ001	2/12/2008	10:00 AM	Winter Storm	N/A	0	0	150K	0K
Montague	2/13/2008	7:45 AM	Flood	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2/22/2008	1:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2/22/2008	1:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2/26/2008	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2/29/2008	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	3/1/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	3/5/2008	8:00 AM	Strong Wind	48 kts.	0	0	10K	0K
Flatbrookville	3/5/2008	12:08 PM	Flood	N/A	0	0	0K	0K
Huntsville	3/8/2008	18:35 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001	3/8/2008	19:30 PM	Strong Wind	43 kts.	0	0	5K	0K
NJZ001 - 007>010 - 012	3/20/2008	4:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ001	3/31/2008	8:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	4/3/2008	23:00 PM	Winter Weather	N/A	0	0	0K	0K
Newton	5/27/2008	15:40 PM	Hail	0.75 in.	0	0	0K	0K
NJZ001 - 007>010 - 012>023 - 026	6/7/2008	9:00 AM	Excessive Heat	N/A	0	10	0K	0K
Vernon	6/7/2008	16:45 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Baleville	6/8/2008	19:26 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Flatbrookville	6/10/2008	18:45 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Mc Coys Corners	6/16/2008	17:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Hainesville	7/8/2008	12:50 PM	Flash Flood	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012>013 - 015>023 - 027	7/16/2008	9:00 AM	Excessive Heat	N/A	0	0	0K	0K
Montague	9/6/2008	15:00 PM	Heavy Rain	N/A	0	0	0K	0K
Montague	10/25/2008	14:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001 - 007	10/28/2008	5:00 AM	Heavy Snow	N/A	0	0	0K	0K
NJZ001 - 007	10/28/2008	5:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012>020 - 022 - 025	10/28/2008	11:00 AM	Strong Wind	40 kts.	0	0	5K	0K
NJZ001	11/30/2008	8:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	12/1/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	12/7/2008	11:00 AM	Strong Wind	48 kts.	0	0	1K	0K
NJZ001	12/10/2008	23:00 PM	Ice Storm	N/A	0	0	1.0M	0K
Culvers Lake	12/11/2008	17:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001	12/16/2008	19:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 008	12/19/2008	10:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001	12/21/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 013>014 - 020 - 022	12/21/2008	22:00 PM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001 - 007 - 008	12/24/2008	3:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	12/26/2008	23:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001	12/27/2008	21:00 PM	Dense Fog	N/A	0	0	0K	0K
NJZ001	12/30/2008	4:00 AM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001	12/31/2008	6:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	12/31/2008	18:00 PM	High Wind	56 kts.	0	0	5K	0K
				Totals:	**0**	**10**	**1.2M**	**0K**

Wayne County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
Honesdale	3/8/2008	17:30 PM	Flash Flood	N/A	0	0	0K	0K
Hawley	4/1/2008	18:55 PM	Hail	0.88 in.	0	0	0K	0K
Bethany	6/7/2008	15:20 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Niarara	6/8/2008	15:00 PM	Thunderstorm Wind	50 kts.	0	0	1K	0K
South Canaan	6/8/2008	18:15 PM	Hail	0.88 in.	0	0	0K	0K
Lake Ariel	6/10/2008	16:05 PM	Hail	1.25 in.	0	0	0K	0K
Honesdale	6/10/2008	16:21 PM	Hail	0.88 in.	0	0	0K	0K
Equinunk	6/10/2008	19:03 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Waymart	6/10/2008	19:10 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Honesdale	6/10/2008	19:15 PM	Hail	1.75 in.	0	0	0K	0K
Angels	6/16/2008	15:30 PM	Hail	0.88 in.	0	0	0K	0K
Honesdale	6/16/2008	15:45 PM	Hail	1.75 in.	0	0	0K	0K
Angels	7/27/2008	14:38 PM	Hail	1.00 in.	0	0	0K	0K
Hawley	8/14/2008	12:19 PM	Hail	1.00 in.	0	0	0K	0K
PAZ038>040 - 043>044 - 047>048 - 072	12/19/2008	9:00 AM	Heavy Snow	N/A	0	0	0K	0K
				Totals:	**0**	**0**	**5K**	**0K**

Sullivan County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
037 - 041>042 - 045>046 - 049>053 - 058	2/1/2008	3:00 AM	Winter Storm	N/A	0	0	0K	0K
Sonestown	2/6/2008	18:56 PM	Hail	1.00 in.	0	0	0K	0K
Shunk	3/5/2008	3:00 AM	Flood	N/A	0	0	0K	0K
Forksville	7/26/2008	17:22 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
PAZ042	10/28/2008	5:00 AM	Heavy Snow	N/A	0	0	2K	0K
045>046 - 049>053 - 058	12/19/2008	4:00 AM	Winter Storm	N/A	0	0	0K	0K
037 - 041>042 - 045>046 - 058	12/21/2008	23:00 PM	Chill	N/A	0	0	0K	0K
PAZ006 - 012 - 018 - 037 - 041>042 - 045	12/23/2008	22:00 PM	Ice Storm	N/A	0	0	0K	0K
				Totals:	**0**	**0**	**2K**	**0K**

Delaware County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ070	1/3/2008	1:00 AM	Astronomical Low Tide	N/A	0	0	0K	0K
PAZ060 - 68 - 70 - 71	1/17/2008	1:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ067 - 69 - 70	2/5/2008	6:00 AM	Dense Fog	N/A	0	0	0K	0K
PAZ070	2/10/2008	7:00 PM	Astronomical Low Tide	N/A	0	0	0K	0K
PAZ070 - 71	2/12/2008	12:00 PM	Winter Storm	N/A	0	0	0K	0K
Chadds Ford	2/13/2008	12:00 PM	Flood	N/A	0	0	0K	0K
PAZ070 - 71	2/22/2008	2:00 AM	Winter Storm	N/A	0	0	0K	0K
PAZ062 - 70	3/5/2008	8:00 AM	Strong Wind	35 kts	0	0	2K	0K
Florida Park	3/8/2008	5:35 PM	Thunderstorm Wind	56 kts.	0	0	100K	0K
PAZ070 - 71	5/12/2008	7:15 AM	Strong Wind	43 kts.	0	0	10K	0K
Ithan	7/20/2008	8:35 PM	Thunderstorm Wind	50 kts.	0	0	0K	
Boothwyn	7/27/2008	1:17 PM	Hail	0.75 in.	0	0	0K	0K
Boothwyn	7/27/2008	1:17 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Marcus Hook	8/10/2008	11:32 AM	Hail	1 in.	0	0	0K	0K
Chadds Ford	9/6/2008	12:00 PM	Heavy Rain	N/A	0	0	0K	0K
PAZ070	9/6/2008	5:00 PM	Storm Surge/tide	N/A	0	0	0K	0K
Radnor	9/9/2008	9:00 AM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Wayne	9/28/2008	12:00 PM	Flood	N/A	0	0	0K	0K
PAZ070	11/21/2008	4:00 AM	Winter Weather	N/A	0	0	0K	0K
Ridley Park	12/12/2008	1:57 AM	Flood	N/A	0	0	0K	0K
PAZ068>071	12/21/2008	4:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ067 - 70 - 71	12/23/2008	10:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ070	12/31/2008	7:00 PM	Astronomical Low Tide	N/A	0	0	0K	0K
				TOTALS:	**0**	**0**	**112K**	**0**

Orange County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NYZ067 - 068	2/1/2008	9:00 AM	Ice Storm	N/A	0	0	0K	0K
Cornwall	2/1/2008	20:27 PM	Flash Flood	N/A	0	0	0K	0K
NYZ067 - 068	2/12/2008	14:00 PM	Winter Storm	N/A	0	0	0K	0K
NYZ067>070	2/22/2008	8:00 AM	Heavy Snow	N/A	0	0	0K	0K
Middletown	3/8/2008	14:30 PM	Flash Flood	N/A	0	0	0K	0K
Montgomery	3/8/2008	15:00 PM	Flash Flood	N/A	0	0	0K	0K
Mechanicstown	3/8/2008	15:15 PM	Flash Flood	N/A	0	0	0K	0K
Montgomery Co Arpt	3/8/2008	15:20 PM	Flash Flood	N/A	0	0	0K	0K
NYZ067	3/8/2008	19:20 PM	High Wind	55 kts.	0	0	0K	0K
Allard Corners	3/8/2008	22:08 PM	Flood	N/A	0	0	0K	0K
Warwick	5/27/2008	13:30 PM	Hail	0.75 in.	0	0	0K	0K
Goshen	6/10/2008	19:40 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
Highland Falls	6/10/2008	19:59 PM	Thunderstorm Wind	61 kts.	0	0	6K	0K
New Windsor	6/10/2008	20:00 PM	Thunderstorm Wind	61 kts.	0	0	5K	0K
Newburgh Stewart Arp	6/10/2008	20:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Orange Lake	6/16/2008	17:15 PM	Tornado	F0	0	0	40K	0K
Newburgh	6/16/2008	18:00 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
Highland Falls	7/23/2008	19:21 PM	Flash Flood	N/A	0	0	0K	0K
Cornwall	7/23/2008	22:30 PM	Flash Flood	N/A	0	0	0K	0K
New Windsor	8/11/2008	10:45 AM	Hail	0.75 in.	0	0	0K	0K
Warwick	8/11/2008	10:55 AM	Flash Flood	N/A	0	0	0K	0K
Newburgh	8/11/2008	11:05 AM	Hail	1.75 in.	0	0	0K	0K
Goshen	8/14/2008	13:13 PM	Hail	0.75 in.	0	0	0K	1K
Monroe	8/14/2008	13:47 PM	Hail	0.88 in.	0	0	0K	0K
NYZ067>081	9/6/2008	13:00 PM	Tropical Storm	N/A	0	0	4K	0K
Highland Falls	9/6/2008	16:30 PM	Flash Flood	N/A	0	0	0K	0K
Cornwall	9/9/2008	10:00 AM	Flash Flood	N/A	0	0	0K	0K
NYZ067	12/11/2008	7:00 AM	Ice Storm	N/A	0	0	0K	0K
NYZ067 - 069	12/19/2008	11:45 AM	Heavy Snow	N/A	0	0	0K	0K
				Totals:	**0**	**0**	**55K**	**1K**

Warren County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012 - 015 - 019	1/9/2008	10:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ007	1/13/2008	22:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ007 - 010 - 012 - 015	1/17/2008	15:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	1/29/2008	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	1/30/2008	9:00 AM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001 - 007	2/1/2008	7:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007	2/1/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 009	2/5/2008	3:00 AM	Dense Fog	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2/10/2008	12:00 PM	High Wind	52 kts.	0	0	25K	0K
NJZ001 - 007>010 - 012	2/10/2008	12:00 PM	Strong Wind	40 kts.	0	0	2K	0K
NJZ007 - 008	2/12/2008	11:00 AM	Winter Storm	N/A	0	0	25K	0K
Millbrook	2/13/2008	7:45 AM	Flood	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2/22/2008	1:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2/22/2008	1:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2/29/2008	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	3/1/2008	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	3/5/2008	8:00 AM	Strong Wind	48 kts.	0	0	10K	0K
Martins Creek Station	3/5/2008	10:00 AM	Flood	N/A	0	0	0K	0K
Alpha	3/8/2008	13:00 PM	Flash Flood	N/A	0	0	0K	0K
NJZ007 - 009 - 012 - 014>015 - 017>020 - 026	3/8/2008	19:00 PM	High Wind	50 kts.	0	0	10K	0K
NJZ007 - 009 - 012 - 014>015 - 017>020 - 026	3/8/2008	19:00 PM	Strong Wind	43 kts.	0	0	5K	0K
NJZ001 - 007>010 - 012	3/20/2008	4:00 AM	Strong Wind	40 kts.	0	0	1K	0K
Blairstown	4/1/2008	20:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Hazen	4/1/2008	20:10 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001 - 007>010 - 012>023 - 026	6/7/2008	9:00 AM	Excessive Heat	N/A	0	10	0K	0K
Vienna	6/14/2008	17:10 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Phillipsburg	6/14/2008	18:47 PM	Lightning	N/A	0	4	0K	0K
Franklin Grove	6/16/2008	16:55 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001 - 007>010 - 012>013 - 015>023 - 027	7/16/2008	9:00 AM	Excessive Heat	N/A	0	0	0K	0K
Stewartsville	9/6/2008	17:00 PM	Flood	N/A	0	0	0K	0K
Franklin Grove	10/25/2008	14:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001 - 007	10/28/2008	5:00 AM	Heavy Snow	N/A	0	0	0K	0K
NJZ001 - 007	10/28/2008	5:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012>020 - 022 - 025	10/28/2008	11:00 AM	Strong Wind	40 kts.	0	0	5K	0K
NJZ001 - 007>010 - 012	12/7/2008	11:00 AM	Strong Wind	48 kts.	0	0	1K	0K
Finesville	12/11/2008	17:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ007	12/16/2008	17:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 008	12/19/2008	10:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ007	12/21/2008	1:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 013>014 - 020 - 022	12/21/2008	22:00 PM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001 - 007 - 008	12/24/2008	3:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ007 - 008	12/27/2008	18:00 PM	Dense Fog	N/A	0	0	0K	0K
NJZ007 - 013>014 - 019>020 - 026	12/30/2008	5:00 AM	Strong Wind	41 kts.	0	0	1K	0K
NJZ007	12/31/2008	7:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ007>010 - 012>015 - 018>020 - 026	12/31/2008	11:00 AM	Strong Wind	40 kts.	0	0	1K	0K
				TOTALS:	**0**	**14**	**90K**	**0**

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS XXXXXX, February, 2010

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